

Practice task

Achievement Standard Chemistry 91393

Demonstrate understanding of oxidation-reduction processes

Electrochemistry

Level 3

Credits: 3

Recommended time to complete: 1 hour

Assessment conditions: Closed book

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of oxidation-reduction processes.	Demonstrate in-depth understanding of oxidation-reduction processes.	Demonstrate comprehensive understanding of oxidation-reduction processes

Student instructions

Introduction

This activity requires you to write a report demonstrating your understanding of oxidation-reduction in the context of electrolytic and electrochemical cells.

You are required to answer **both** questions.

You will be assessed on how comprehensive your understanding of the oxidation-reduction processes is demonstrated in this report.

Throughout your report, use correct chemical vocabulary, symbols and conventions.

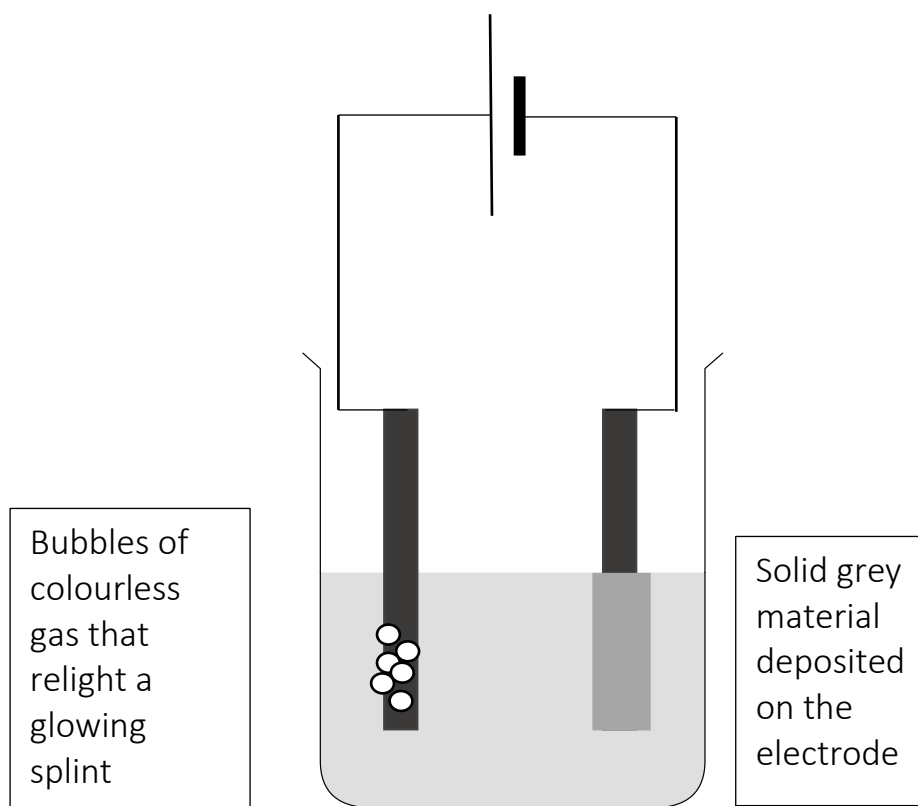
You will be provided with a chart of redox species and their appearance.

The following standard reduction potentials may be useful: not all will be used.

O_2 / H_2O	1.23 V	Zn^{2+} / Zn	-0.76 V
H^+ / H_2	0.00 V	Pb^{2+} / Pb	-0.13 V
H_2O / H_2	-0.83 V	MnO_4^- / Mn^{2+}	1.51 V
H_2O_2 / H_2O	1.78 V	Fe^{3+} / Fe^{2+}	0.77 V

Part One Electrolysis

This diagram shows an electrolytic cell. Electrolysis of lead nitrate $\text{Pb}(\text{NO}_3)_2$ (aq) is carried out using 2 carbon electrodes.



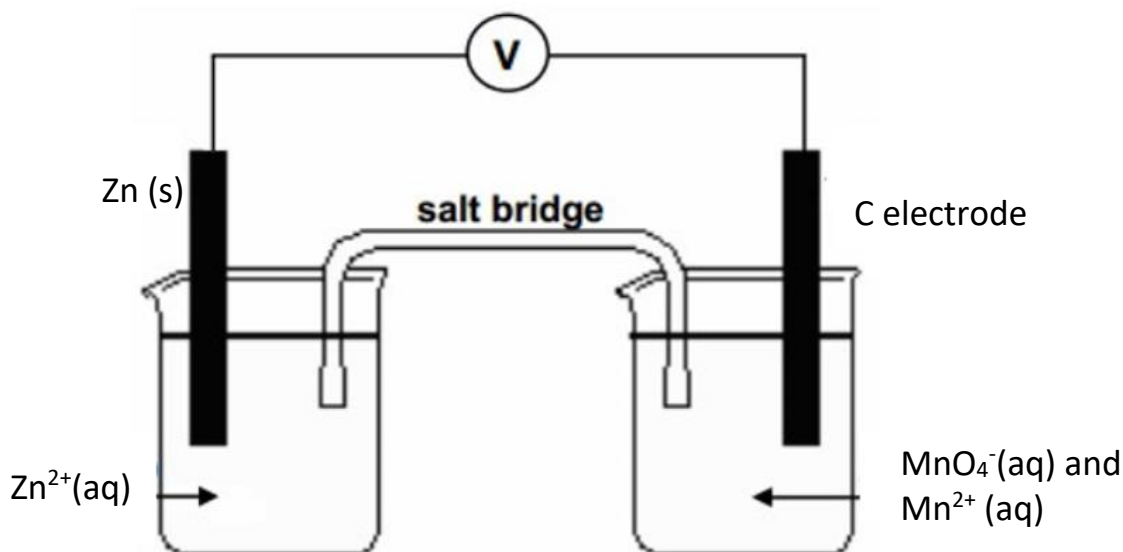
Write a report on the oxidation-reduction processes occurring in this electrolytic cell.

Include in your report:

- Identify the anode and cathode electrodes with their respective charges
- Describe the observations at each electrode, clearly linked to the species involved.
- Describe the redox process that occurs at each electrode, identifying the species oxidised and reduced by name or formula.
- Write balanced half equations for the both oxidation and reduction processes.
- Write a fully balanced redox equation.
- Justify both redox processes occurring using oxidation numbers **and/or** the loss or gain of electrons. (You must state how many electrons are lost or gained).
- Use standard reduction potentials to work out the cell potential in order to determine/predict spontaneity and the requirements to bring about electrolysis of zinc sulfate solution.

Part Two Electrochemical cells

An electrochemical cell was set up as below, with two half cells, one containing Zn^{2+}/Zn and the other $\text{MnO}_4^-/\text{Mn}^{2+}$ with a carbon (C) electrode.



Write a report on the oxidation-reduction processes occurring in this electrochemical cell.

Include in your report:

- Describe the expected observations at each electrode, clearly linked to the species involved.
- Describe the redox process that occurs at each electrode, identifying the species oxidised and reduced by name or formula.
- Write balanced half equations for the both oxidation and reduction processes.
- Write a fully balanced redox equation.
- Justify both redox processes occurring using oxidation numbers **and/or** the loss or gain of electrons. (You must state how many electrons are lost or gained).
- Write the cell diagram for this cell (not assessed) and determine potential difference of the cell.
- Explain the spontaneity of the cell with reference to the standard reduction potentials.